



MS APPEAL BRIEF - PATENTS
PATENT
1592-0131P

IN THE U.S. PATENT AND TRADEMARK OFFICE

In re application of Before the Board of Appeals

Shigeto FUJIMURA et al. Appeal No.:

Appl. No.: 09/753,662 Group: 1765

Filed: January 4, 2001 Examiner: M. A. ANDERSON

Conf.: 1881

For: PROCESS FOR PRODUCING COMPOUND
 SEMICONDUCTOR CRYSTAL

RECEIVED
DEC 04 2003
TC 1700

SECOND REQUEST FOR REINSTATEMENT OF APPEAL

MS APPEAL BRIEF - PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

November 21, 2003

Sir:

Applicants submit herewith a Second Request for
Reinstatement of the Appeal pursuant to 37 CFR 1.193(b)(2)(ii).
Attached hereto is a Second Supplemental Appeal Brief that
complies with 37 CFR 1.192(c).

Appellants filed an Appeal Brief with the required fee on
January 16, 2003. The Examiner reopened prosecution on March
18, 2003 by issuing a non-final Office Action. Appellants filed
a Supplemental Appeal Brief on May 27, 2003 addressing the
alleged new grounds of rejection and the previous rejections on

appeal. The Examiner again reopened prosecution on August 21, 2003 by issuing a non-final Office Action. Appellants now submit this Second Request for Reinstatement of the Appeal along with a Second Appeal Brief.

No fee is required with the filing of this Second Request for Reinstatement of the Appeal as \$320.00 was filed on January 16, 2003 with the original Appeal Brief.

However, if necessary, the Commissioner is hereby authorized in this, concurrent, and further correspondence, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

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ATTACHMENT: Second Supplemental Appeal Brief



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SINGLE CRYSTAL

SECOND SUPPLEMENTAL APPEAL BRIEF

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Adjustment date: 12/02/2003 WABDELRI
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SECOND SUPPLEMENTAL BRIEF ON BEHALF OF APPELLANTS

MS APPEAL BRIEF - PATENTS
Commissioner for Patents
P.O. Box 1450
Washington, DC 22313-1450

November 21, 2003

Sir:

This Second Supplemental Appeal Brief is respectfully submitted in connection with the above-identified application after the Examiner reopened prosecution with the Office Action dated August 21, 2003.

(1) REAL PARTY IN INTEREST

As evidenced by the assignment filed on March 12, 2001 and recorded on March 12, 2001 at Reel # 011581 and Frame # 0789,

the real party in interest is Nikko Materials Co., Ltd. of 10-1,
Toranomon 2-chome, Minato-ku, Toyko 105-8407 Japan.

(2) RELATED APPEALS AND INTERFERENCES

There are no related interferences involving the above-identified application. There are no other related appeals. This appeal brief is supplemental to the appeal brief filed January 16, 2003.

(3) STATUS OF THE CLAIMS

Claims 1-12 are pending in the application. Claims 5-10 and 12 are withdrawn from consideration and Claims 1-4 and 11 stand rejected per the Office Action of August 21, 2003, which reopened prosecution for the second time following the filing of Appellants initial Appeal Brief.

(4) STATUS OF THE AMENDMENTS

The Reply to an Office Action filed June 26, 2002 amended claim 1 and added new claims 2-12. All amendments have been entered as of the Final Office Action of August 27, 2002.

(5) SUMMARY OF THE INVENTION

The present invention is directed to a process for producing a compound semiconductor single crystal which

comprises placing the raw material into a crucible, encapsulating the material, setting the crucible in a vertical heating furnace to heat the raw material, melting the material, promoting a nucleation on the surface of a raw material melt by leaving a solid raw material in a part of the raw material melt, solidifying the raw material melt without a seed crystal and growing the crystal by using a nucleus generated by the nucleation.

(6) ISSUES FOR CONSIDERATION

A. **(ALLEGED NEW ISSUE)** Whether the Examiner has established a *prima facie* case of obviousness under 35 U.S.C. §103(a) over Fukuda et al. U.S. Patent 5,554,219 in view of Dutta et al. U.S. Patent 6,273,969 and Kingery et al. *Introduction to Ceramics*, Second Edition, pp.328-346 (1976) when the Examiner has not pointed to any disclosure or suggestion of each and every element of the present invention within the combination of the cited references and when the Examiner has failed to show an objective teaching within the references or in the art that would motivate one of ordinary skill in the art to combine the cited references to arrive at the present invention.

B. **(PREVIOUS ISSUE)** Whether the Examiner has established a *prima facie* case of obviousness under 35 U.S.C. §103(a) over Fukuda et al. U.S. Patent 5,554,219 in view of Dutta et al. U.S. Patent 6,273,969 and Kingery et al. *Introduction to Ceramics*, Second Edition, pp.328-346 (1976) when the Examiner has not pointed to any disclosure or suggestion of each and every element of the present invention within the cited references and when the Examiner has failed to show an objective teaching within the references or in the art that would motivate one of ordinary skill in the art to combine the cited references to arrive at the present invention.

C. **(PREVIOUS ISSUE)** Whether the Examiner has established a *prima facie* case of obviousness under 35 U.S.C. §103(a) over Fukuda et al. U.S. Patent 5,554,219 in view of Dutta et al. U.S. Patent 6,273,969 when the Examiner has not pointed to any disclosure or suggestion of each and every element of the present invention within the cited references and when the Examiner has failed to show an objective teaching within the references or in the art that would motivate one of ordinary skill in

the art to combine the cited references to arrive at the present invention.

D. **(PREVIOUS ISSUE)** Whether the Examiner has established a prima facie case of obviousness under 35 U.S.C. §103(a) over Fukuda et al. U.S. Patent 5,554,219 in view of Dutta et al. U.S. Patent 6,273,969 and further in view of Taniguchi et al. U.S. Patent 5,603,763 when the Examiner has failed to show an objective teaching within the references or in the art that would motivate one of ordinary skill in the art to combine the cited references to arrive at the present invention.

(7) GROUPING OF THE CLAIMS

I. Claims 1-3 and 11.

II. Claim 4.

(8) ARGUMENTS ON THE NEW ISSUE

A. No Prima Facie Case of Obviousness

The Examiner has failed to make a prima facie case of obviousness, as the Examiner has not pointed to the disclosure or suggestion of each and every element of the present invention as defined by the broadest claim, Claim 1. Moreover, the Examiner has failed to point to a clear objective teaching

within the secondary reference or in the field of knowledge that would motivate one of ordinary skill in the art to combine the cited references.

1. Failure to Disclose or Suggest Each and Every Limitation.

According to In re Lowry, 32 USPQ2d 1031, 1035, 32 F.3d 1579 (Fed Cir 1994), a prima facie case of obviousness is established if a cited reference explicitly or inherently discloses or suggests each and every limitation of the claimed invention. The Examiner bears the burden of establishing a prima facie case of obviousness. In re Rijckaert, 9 F.3d 1531, 1532, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993). Appellants submit that the Examiner has failed to establish a prima facie case of obviousness.

The Examiner for the second time after Appellants filed an Appeal Brief attempts to establish a prima facie case of obviousness in Paper No. 20, paragraph 3. The Examiner states that it would have been obvious to one of ordinary skill in the art to arrive at the present invention because U.S. Patent 5,554,219 to Fukuda et al. (hereinafter "Fukuda '219") discloses a delineated process using a VF or VGF furnace in which crystal growth would occur via "nucleation growth" between a raw material, which is melted and a solid portion of the raw material, which has been twice melted.

The Examiner states that the process disclosed in Fukuda '219 is identical to the claimed process of claim 1, except that Fukuda '219 fails to disclose nucleation promoted by a solid raw material and that Fukuda '219 fails to encapsulate the raw material as required by the claim limitation. However, the Examiner relies on U.S. Patent 6,273,969 to Dutta et al. (hereinafter Dutta '969) for disclosing using an encapsulant.

Lastly, the Examiner relies on Kingery et al. for disclosing "that the crystal growth occurred from nuclei existing at the surface of the solid raw material adjacent to the raw material melt because such growth occurred in Fukuda et al. and would have been consistent with the art accepted 'nucleation/growth' hypothesis of crystal growth presented by Kingery et al." The Examiner in the new Office Action reopening prosecution for the second time adds that Kingery et al. "discloses the basic and expected nature of the stages of crystal growth including nucleation and growth (see page 328 and 336)." The Examiner also adds that one of ordinary skill in the art would use the universally accepted nucleation/growth of Kingery in combination with Fukuda '219 and Dutta '969 to arrive at the present invention.

The Examiner suggests that the combination of Fukuda '219, Dutta '969 and Kingery discloses all the elements of the process of claim 1 and that it would have been obvious to one of

ordinary skill in the art "to combine the above references because thereby the growth using a VF method would produce a semiconductor alloy of constant stoichiometry due to the prevention of vaporization and the universally accepted nucleation/growth explanation of crystal formation would be understood."

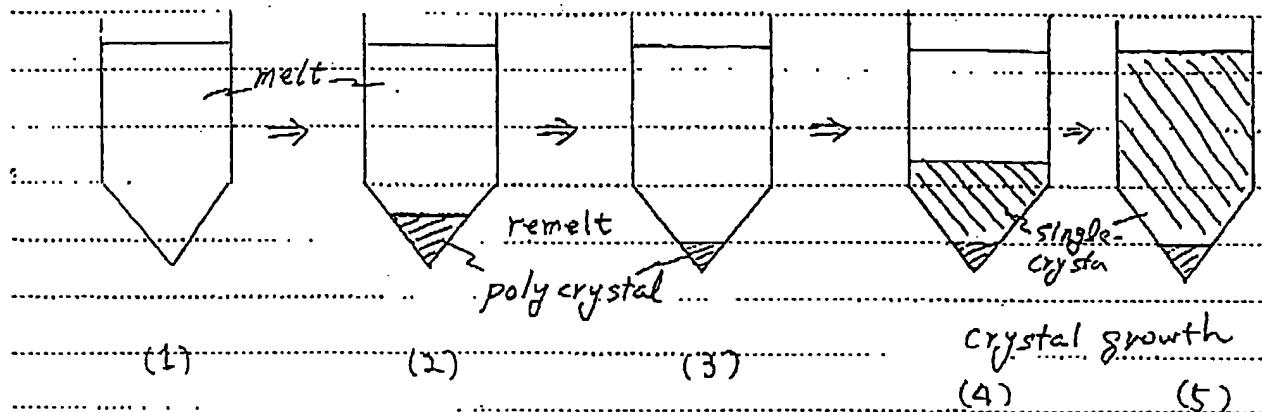
Appellants respectfully disagree with the Examiner's statements. Appellants submit that the Examiner's understanding of Fukuda '219 is technically and factually incorrect. Fukuda '219 discloses six different embodiments for producing a single crystal bulk ZnSe. The first through the fourth and sixth embodiments of Fukuda '219 use a seed crystal to process the single crystal bulk ZnSe. These embodiments of Fukuda '219 are clearly distinguished from the present invention in that they require a seed crystal and the present invention explicitly excludes using a seed crystal.

The fifth embodiment of Fukuda '219, which does not use a seed crystal, is the closest embodiment to the claimed invention. The fifth embodiment of Fukuda '219 produces polycrystalline ZnSe from a ZnSe melt using a high pressure melt technique. After temporary interruption of the growth of the crystal, part of the polycrystalline ZnSe is remelted, followed by growing of a single crystal on the remelted portion of the polycrystalline ZnSe, which is adjacent to the remaining solid

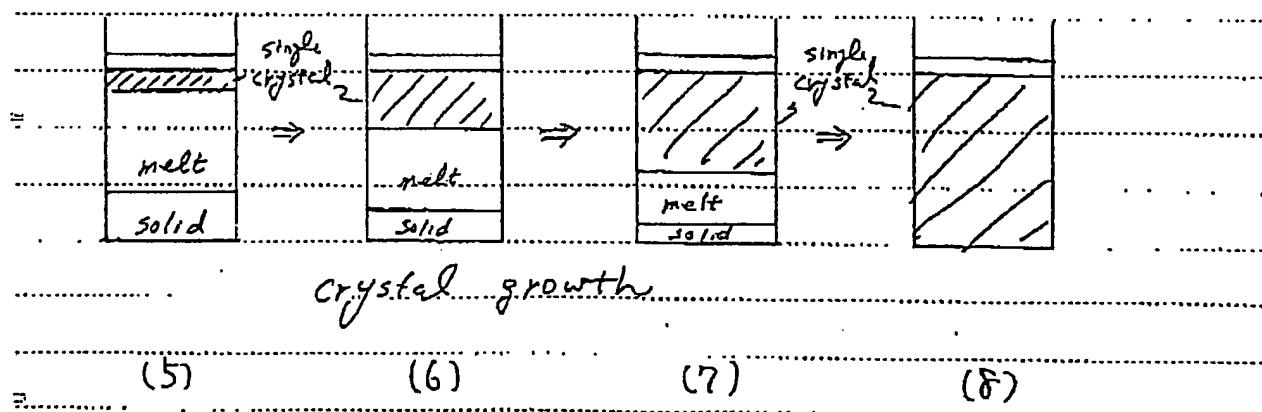
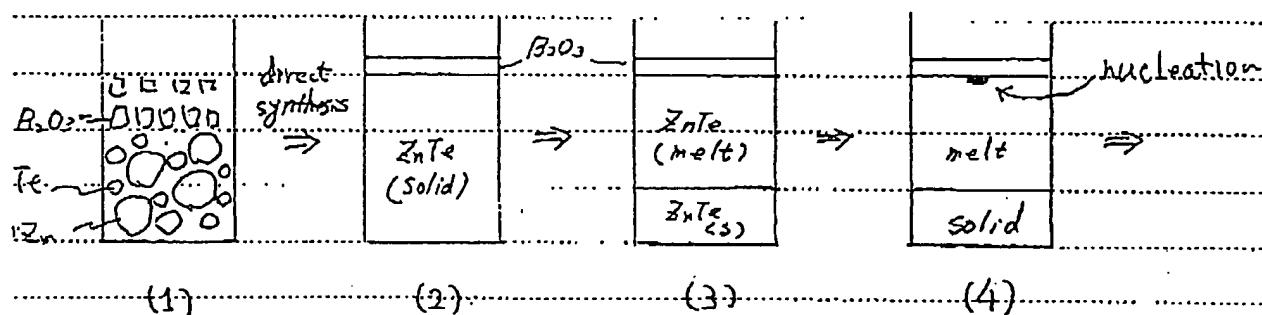
portion of the polycrystalline ZnSe. A large number of nuclei are generated and then a single crystal is obtained by selective growth. The nucleation occurs on the contact surface between the polycrystal and the melt.

The diagram on the following page demonstrates the differences between the 5th embodiment of Fukuda '219 and the present invention.

a fifth method of the Fukuda invention



our invention



The diagram, which was previously submitted as an attachment to the Reply filed June 26, 2002, shows a five step process. The steps of Fukuda '219 are (1) melting the raw material in a crucible, (2) allowing a polycrystal to form on the bottom of the crucible, (3) partially remelting the formed polycrystal, (4) nucleation taking place on the bottom surface of the raw material adjacent to the polycrystal and (5) forming the single crystal on top of the polycrystal, where the single crystal is grown from the bottom of the crucible to the top.

On the other hand, as demonstrated in the diagram, the present invention comprises placing a compound semiconductor raw material into a crucible; encapsulating the raw material; setting the crucible in a vertical type of a heating furnace to heat the raw material; melting the raw material; promoting a nucleation on a surface (i.e. just under the encapsulant) of a raw material melt by leaving a solid raw material in a part of the raw material melt (i.e. at the bottom of the crucible); solidifying the raw material gradually from the surface of the raw material melt without a seed crystal; and growing a crystal by using a nucleus generated by the nucleation.

Fukuda '219 fails to disclose or suggest nucleation that occurs on the surface of the melt (i.e. just below the encapsulant). Fukuda '219 does not even disclose or suggest using an encapsulant. Contrary to the Examiner's contention,

Fukuda '219 also fails to disclose solidifying the melt gradually from the surface of the melt. As such, Appellants submit that Fukuda '219 fails to disclose or suggest process steps b), e) and f) of the present invention as claimed in claim 1.

The Examiner recognizing Fukuda '219's failure to disclose using an ensapsulant relies upon the teachings of Dutta '969 in an attempt to suggest the present invention. Dutta '969 discloses a process for making alloys of semiconductors including ZnSe by VF methods and by using an encapsulant such as B₂O₃. However, Dutta '969 does not disclose or suggest nucleation that occurs on the surface of the melt just below the encapsulant. Dutta '969 also does not disclose or suggest solidifying the melt gradually from the top surface of the melt. Appellants submit that Dutta '969 fails to disclose or suggest process steps e) and f) of the present invention.

Upon review of Applicants arguments in the Appeal Brief of January 16, 2003 and the Supplemental Appeal Brief of May 27, 2003, the Examiner in an alleged new rejection relies on Kingery et al. (See page 4, lines 3-4 and lines 8-13 of the paper 20) for allegedly disclosing the basic and expected nature of the steps of crystal growth including nucleation and growth. The Examiner fashions an alleged new issue by stating that one of ordinary skill in the art would use the universally accepted

nucleation/growth of Kingery to understand crystal formation so as to arrive at the present invention from combining Fukuda '219 and Dutta '969.

However, Kingery fails to disclose forming a single crystal from a raw material without a seed crystal, where the raw material is gradually solidified from the surface of the raw material melt. Kingery fails to provide the missing elements to compensate for the lack in Fukuda '219 and Dutta '969.

Therefore, even the combination of Dutta '969, Fukuda '219 and Kingery (assuming that there is some objective teaching to combine the references) fails to disclose or suggest all of the elements of the process recited in claim 1. Applicants submit that Step f) is never disclosed or suggested by the combination of the references. As such, the Examiner has failed to meet the burden of establishing a prima facie case of obviousness as required by In re Lowry, supra, to point to the disclosure or suggestion of each and every limitation of the claimed invention. As such, the rejection should be reversed on this basis alone.

2. No Motivation To Combine the References

The Examiner has also failed to establish a prima facie case of obviousness by failing to establish that one of ordinary skill in the art would be motivated to combine Fukuda '219,

Dutta '969 and Kingery to arrive at the present invention as defined by the broadest claim, Claim 1.

According to In re Fine, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988), a prima facie case of obviousness is established when the Examiner shows that some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the cited references. The Examiner has failed to make such a showing.

Moreover, it is not prima facie obvious to modify a reference unless the secondary references suggest an advantage to be gained from the modification. See In re Sernaker, 217 USPQ 1, 6 (Fed. Cir. 1983). The cited references must suggest the desirability of the modification. In re Brouwer, 37 USPQ2d 1663, 1666 (Fed. Cir. 1995).

Fukuda '219 does not suggest or even hint at using an encapsulant or having nucleation occur on the surface of the melt. In fact, in Fukuda '219, nucleation occurs at the bottom on the melt. This is demonstrated in the diagram, supra.

Dutta '969 does not suggest an advantage to be gained by the Examiner's proposed modifications of using the encapsulant of Dutta '969 with the method disclosed in Fukuda '219.

Moreover, Kingery does not disclose forming a single crystal without a seed crystal to be combinable with the primary reference. Kingery also fails to disclose or suggest using the encapsulate of Dutta '969 with the process of Fukuda '219 and allowing the nucleation to occur at the surface of the melt so that the crystal grows from the surface downward.

The Examiner asserts that one of ordinary skill in the art would be motivated to combine the disclosure of Dutta '969 with the disclosure of Fukuda '219 and Kingery, because Dutta '969 discloses making alloys of semiconductors by using an encapsulant with the VF method and Kingery discloses a surface nucleation. The Examiner asserts that one of ordinary skill in the art would be motivated to combine the references to produce a semiconductor alloy of constant stoichiometry.

Appellants submit that the Examiner is using impermissible hindsight to reconstruct the present invention. The Examiner merely relies on Appellants' own teachings to form the obviousness rejection. The Examiner has taken the present invention and simplified it and divided it into separate steps, i.e., encapsulating the raw material, melting the raw material, nucleation at the surface and solidifying the raw to form the

crystal. The Examiner in an attempt to make a *prima facie* case of obviousness searched for the individual steps in separate references. However, none of the references suggest combining the steps to arrive at the present invention. Such hindsight reconstruction is impermissible according to MPEP 2141 and In re Deminski, 796 F.2d 436, 443 230 USPQ 313, 316 (Fed. Cir. 1986).

Dutta '969 fails to provide a teaching that would motivate one of ordinary skill in the art to use the encapsulant with the process in Fukuda '219. Dutta '969 also fails to provide a teaching that would motivate one of ordinary skill to use the teachings in Kingery with both Dutta '969 and Fukuda '219. Finally, Kingery fails to provide motivation or even a hint of a suggestion for one of ordinary skill in the art to use the encapsulant of Dutta '969 with the process in Fukuda '219 with the teachings in Kingery for nucleation and growth.

At best, the Examiner has pointed out a combination of references that make it "obvious to try" to attain the claimed invention. "Obvious to try" is not the standard under which to reject claims under 35 USC 103. See In re Dow Chemical Co., 5 USPQ2d 1521, 1532 (Fed. Cir. 1988) (rejecting the "obvious to try" standard).

As such, Appellants submit that the Examiner has not established a *prima facie* case of obviousness and the rejection should be reversed.

Regarding issues B, C and D, Appellants hereby incorporate by reference all arguments set forth in the Brief filed on January 16, 2003 and the Supplemental Appeal Brief filed on May 27, 2003.

C. Conclusion

For the foregoing reasons, it is respectfully submitted that all claims in this application are allowable. Favorable reconsideration by the Honorable Board of Patent Appeals and Interferences is respectfully solicited.

If necessary, the Commissioner is hereby authorized in this, concurrent, and further replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

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MSW/KJR/
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Attachment: Appendix - Claims on Appeal

(9) APPENDIX

CLAIMS ON APPEAL

1. A process for producing compound semiconductor single crystal, comprising the steps of:

- a) placing a compound semiconductor raw material into a crucible;
- b) encapsulating the raw material;
- c) setting the crucible in a vertical type of a heating furnace to heat the raw material;
- d) melting the raw material;
- e) promoting a nucleation on a surface of a raw material melt by leaving a solid raw material in a part of the raw material melt;
- f) solidifying the raw material gradually from the surface of the raw material melt without a seed crystal; and
- g) growing a crystal by using a nucleus generated by the nucleation.

2. The process of claim 1, wherein the raw material is ZnTe or CdTe.

3. The process of claim 1, wherein B₂O₃ is used to encapsulate the raw material.

4. The process of claim 1, wherein nucleation occurs on a top surface of raw material melt.

11. The process of claim 1, wherein nucleation occurs on a surface adjacent to the raw material melt.